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Eucalyptus for short rotation forestry in GB

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Presentation for the ShortFor Conference,
Teagasc Ashtown Food Research Centre
Monday 11th December 2017

Content

1. *Eucalyptus* species used in UK,
2. Frost hardiness (with context of UK and Scotland in particular being very different to Ireland climatically),
3. Provenance and sourcing of planting material,
4. Products and marketing in UK.

Why *Eucalyptus*?

Advantages:

- High productivity on short rotations
- Relatively free of damaging pests and diseases
- Lots of knowledge of the genus
- Low environmental impact (?)

Disadvantages:

- Little experience in UK and Ireland
- High moisture content and problematic wood chemical composition
- Hardiness

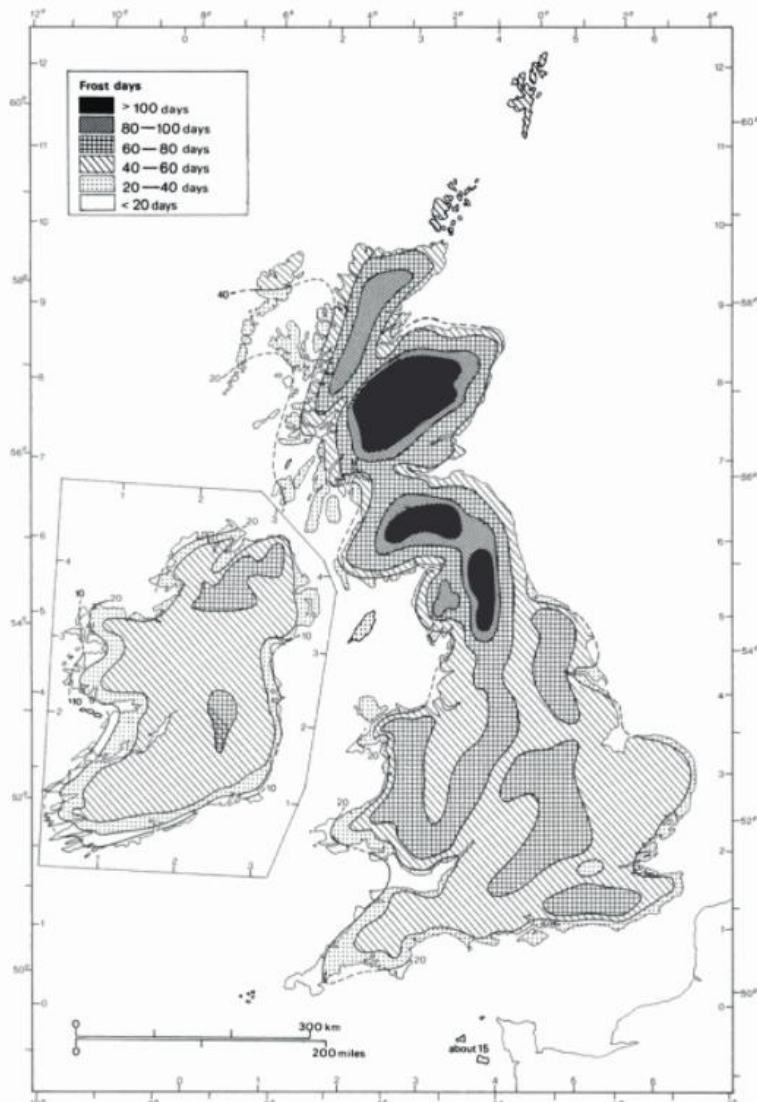


Figure 1 Frost days in UK and Ireland ([Page 1997](#))

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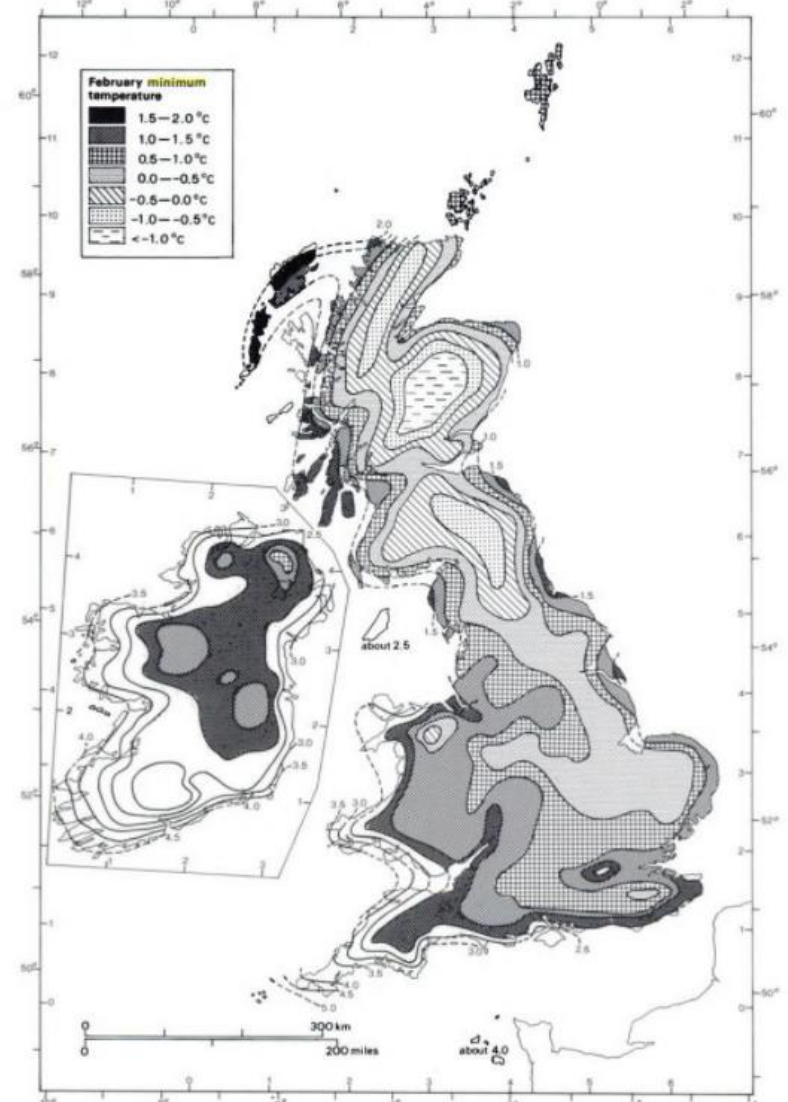


Figure 2 February minimum temperatures (°C) in UK and Ireland ([Page 1997](#))

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TEN
years
2007-2017

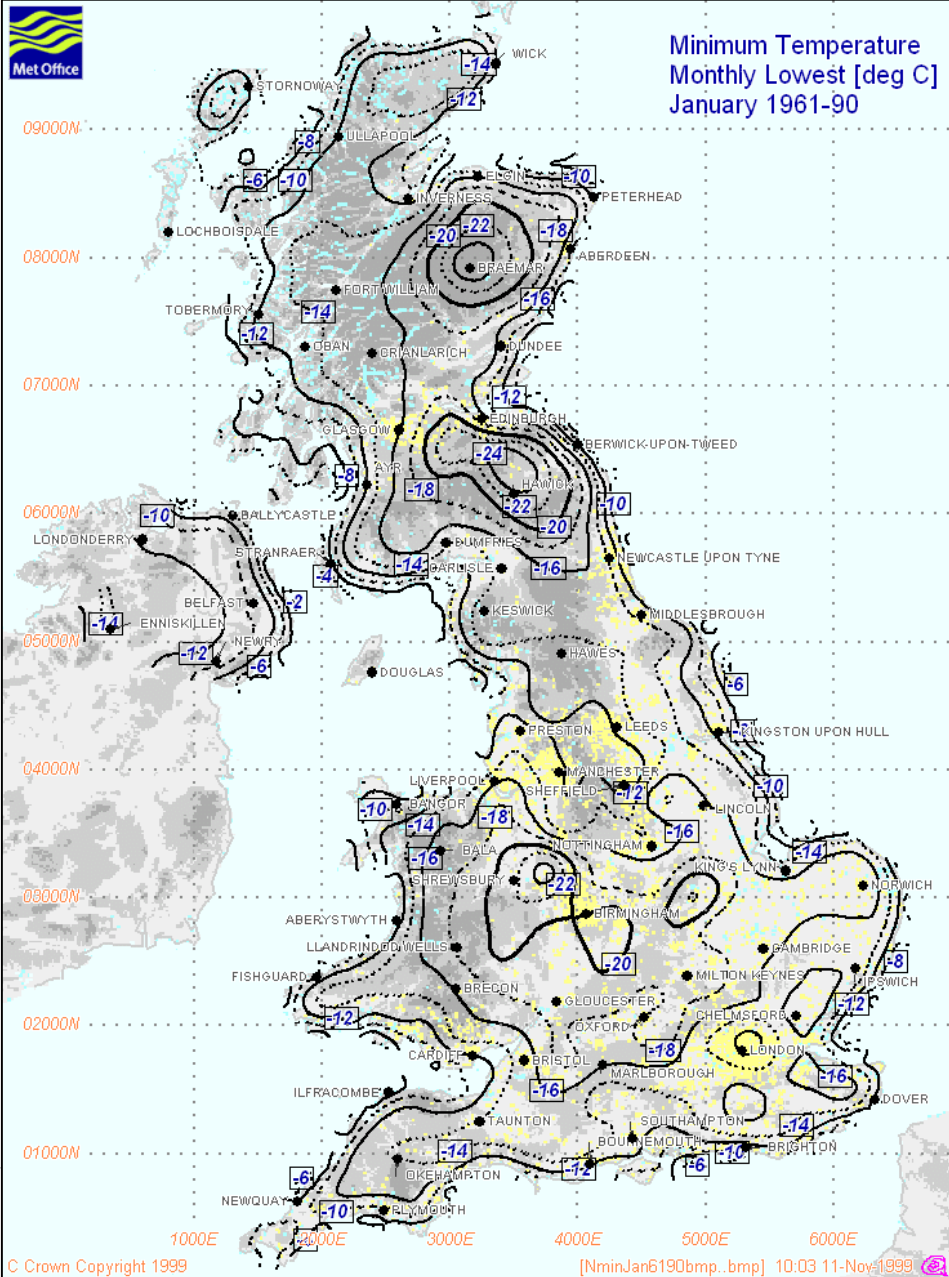
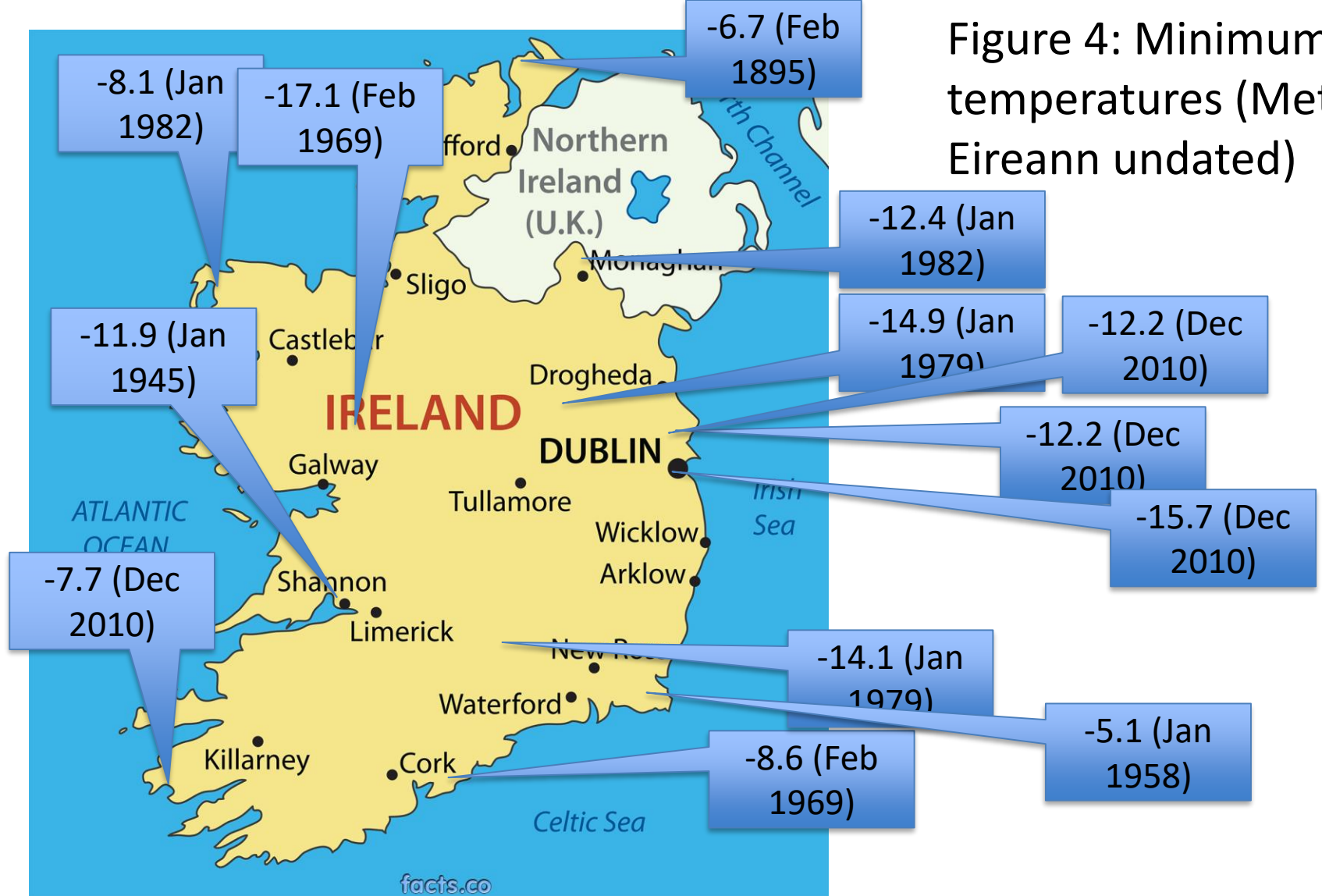


Figure 3 Minimum temperature for January (1961-1990). (Met Office undated)

Figure 4: Minimum temperatures (Met Eireann undated)



Which Eucalyptus?

Figure 5

Comparison of latitude and area of Europe and Australia (adapted from Turnbull and Eldridge 1983) – Distributions – black = *E. gunnii*, Grey = *E. nitens*



Table 1 Cold tolerance of species evaluated in a cold chamber.

Greatest cold tolerance = Highest LT50 mean, highest LT50 min and lowest seasonal variance (Black unpublished)

Species	LT50 Mean	LT50 Min	Seasonal variance	Overall rank
<i>E. rodwayii</i>	-10.3	-12.3	2.28	3.0
<i>E. glaucescens</i>	-9.0	-10.1	0.99	3.3
<i>E. subcrenulata</i>	-9.5	-11.9	2.24	3.3
<i>E. delegatensis</i>	-8.8	-10.9	1.87	4.0
<i>E. gunnii</i>	-8.9	-10.4	2.17	4.3
<i>E. coccifera</i>	-8.0	-8.8	0.87	4.7
<i>E. nitens</i>	-7.7	-9.8	1.50	5.3

Figure 6 Sites of main eucalypt trials established in the 1980's in Great Britain.
 1 = Alice Holt,
 2 = Dalmacallan,
 3 = Dalton,
 4 = Dyfnant,
 5a = Exeter, 5b = Tintern, 5c = Wareham,
 6 = Glasfynydd,
 7=Glenbranter,
 8=Thetford,
 9 = Wark. (Evans 1986)

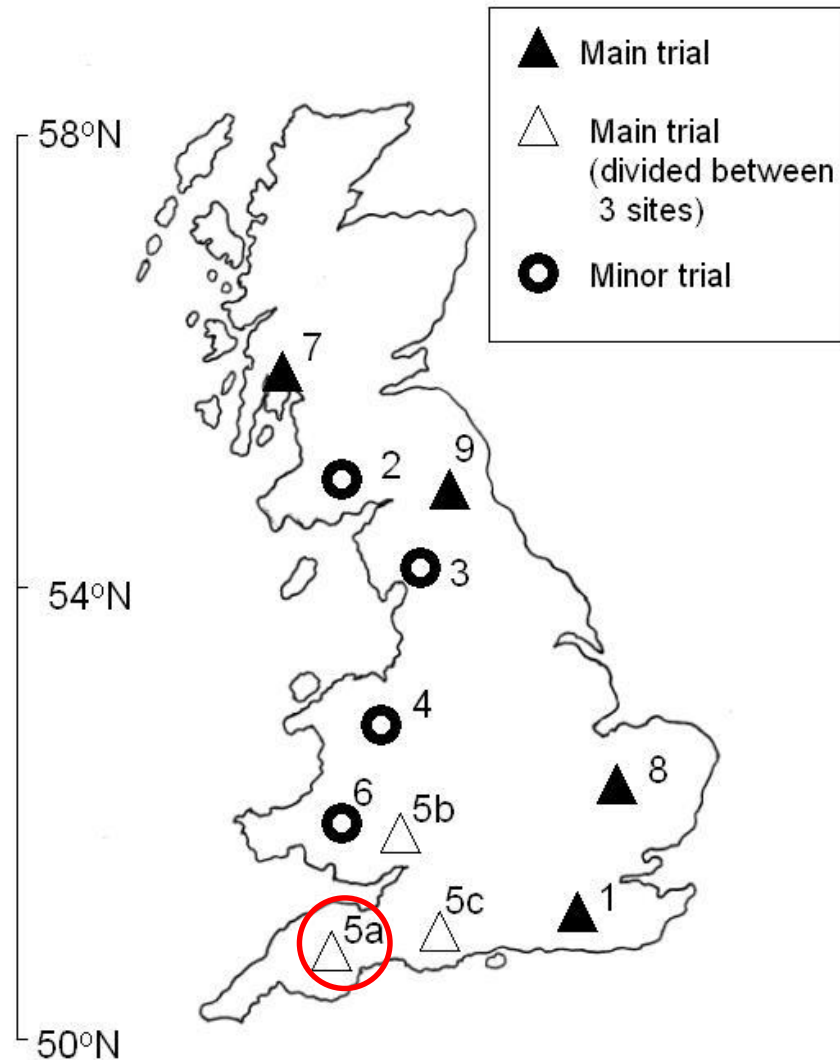


Table 1. Mean basal area, mean height, mean survival and quadratic mean dbh by species after 28 growing seasons at Haldon Forest (Exeter)

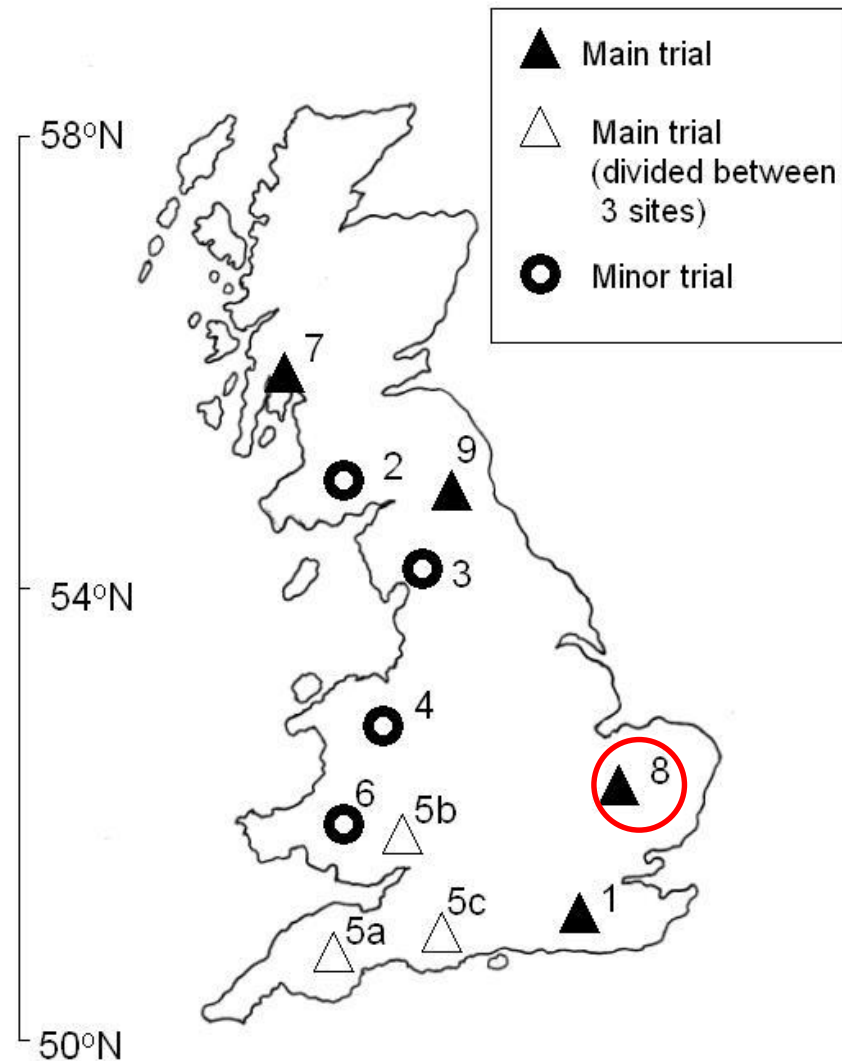
1 This comprises origins 24 and 134, identified as *E. nitida*. 2 This comprises origins that are *E. coccifera*, not origins 24 and 134 which are likely to be *E. nitida*. 3 comprises *E. delegatensis ssp tasmaniensis*. 4 comprises *E. delegatensis ssp delagetensis*.

	Mean % Survival	Quadratic mean dbh (cm)	Mean height (m)	Mean basal area (m ² ha ⁻¹)	Mean volume (m ³ ha ⁻¹)	Mean t MAI (m ³ ha ⁻¹ y ⁻¹)
<i>E. nitida</i> ¹	4.6	32.0	20.0	13.7	95.9	3.4
<i>E. coccifera</i> ²	17.9	39.5	21.3	40.3	301.0	10.8
<i>E. delegatensis</i>	15.6	49.3	20.1	43.4	305.3	10.9
<i>E. delegatensis</i> (t) ³	17.3	51.9	19.2	67.1	452.4	16.2
<i>E. delegatensis</i> (d) ⁴	10.4	42.5	19.1	27.3	183.1	6.5
<i>E. subcrenulata</i>	62.2	30.4	21.1	84.7	634.3	21.9
<i>E. johnstonii</i>	26.0	27.4	21.5	26.8	201.8	7.0



Figure 7 Tasmanian oak : *Eucalyptus delegatensis*
(28 years old)

Figure 8 Sites of main eucalypt trials established in the 1980's in Great Britain.
 1 = Alice Holt,
 2 = Dalmacallan,
 3 = Dalton,
 4 = Dyfnant,
 5a = Exeter, 5b = Tintern, 5c = Wareham,
 6 = Glasfynydd,
 7=Glenbranter,
 8=Thetford,
 9 = Wark. (Evans 1986)



Thetford FC Trial

Seed lot	Code	Origin
<i>E. gunnii</i> var <i>divaricata</i> (3)	3	Tasmania, 1100 m a.s.l., hardies t eucalypt tried in Eire
<i>E. gunnii</i> (5)	5	Tasmania, 1235 m a.s.l.
<i>E. gunnii</i> (8A)	8A	Seed from one tree, Lyndhurst, Hampshire
<i>E. archeri</i> (12)	12	Tasmania 1310 m a.s.l.
<i>E. gunnii</i> (16)	16	Lochbranter
<i>E. coccifera</i> (24)	24	Cornwall
<i>E. debeuzevillei</i> (29)	29	Seed from one tree, Bovey Tracy, Devon
<i>E. glaucescens</i> (34)	34	Seed from one tree, Bovey Tracy, Devon
<i>E. niphophila</i> (41)	41	Exeter University
<i>E. nitens</i> (45)	45	Seed from Kilmun, Scotland
<i>E. nitens</i> X <i>parvifolia</i> (49)	49	No record

Table 2 Origin of the Provenances, varieties and hybrids used in the Thetford Trial (Forestry Commission 1980)

Table 3 Results of dbh, height and survival at Thetford after twenty-one growing seasons. * *E. debeuzevillei* one replicate planted and *E. nitens* X *parvifolia* two replicates planted.

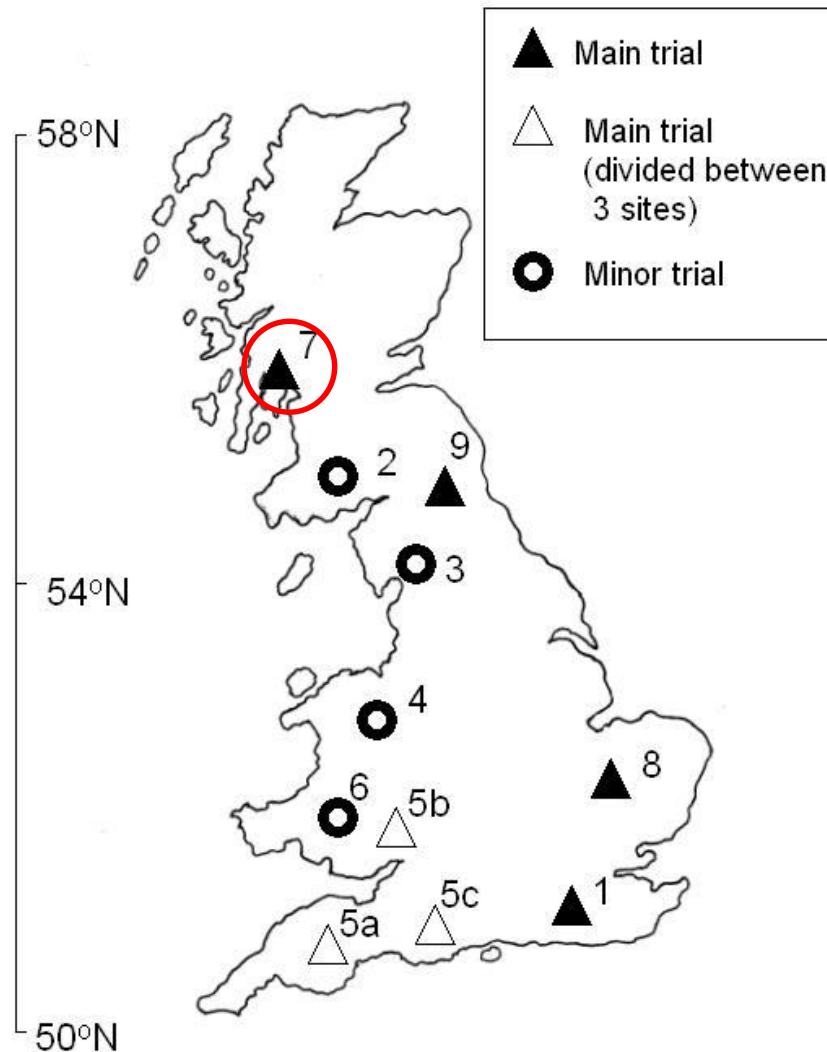
Seed lot	Mean dbh (cm)	Mean Height (m)	Survival (%)	MAI (m ³ ha ⁻¹ y ⁻¹)
<i>E. gunnii</i> var <i>divaricata</i> (3)	23.1	19.6	42	13.5
<i>E. gunnii</i> (5)	23.2	20.8	53	18.2
<i>E. gunnii</i> (8A)	21.9	19.3	50	14.2
<i>E. archeri</i> (12)	24.9	20.5	47	18.4
<i>E. gunnii</i> (16)	19.5	12.8	33	4.9
<i>E. coccoifera</i> (24)	30.8	12.9	14	4.2
<i>E. debeuzevillei</i> (29)*	15.5	11	11	0.9
<i>E. glaucescens</i> (34)	24.7	28	31	16.2
<i>E. niphophila</i> (41)	12.5	28	28	1.1
<i>E. nitens</i> (45)	0	0	0	0.0
<i>E. nitens</i> X <i>parvifolia</i> (49)*	0	0	0	0.0

Corsican pine,
YC14 at this age
would be
growing at 6 m³
ha⁻¹ y⁻¹

Volumes derived from a form factor of 0.35 (Purse and Richardson 2001), while volume/ha assumes stocking density of 1,850 stems/ha.

Figure 9 Sites of main eucalypt trials established in the 1980's in Great Britain.

1 = Alice Holt, 2 = Dalmacallan, 3 = Dalton, 4 = Dyfnant, 5a = Exeter, 5b = Tintern, 5c = Wareham, 6 = Glasfynydd, 7=Glenbranter, 8=Thetford, 9 = Wark. (Evans 1986)



E. gunnii Glenbranter

Figure 10 25 year results from a *E. gunnii* provenance trial at Glenbranter (Cope, Leslie and Weatherall 2008)

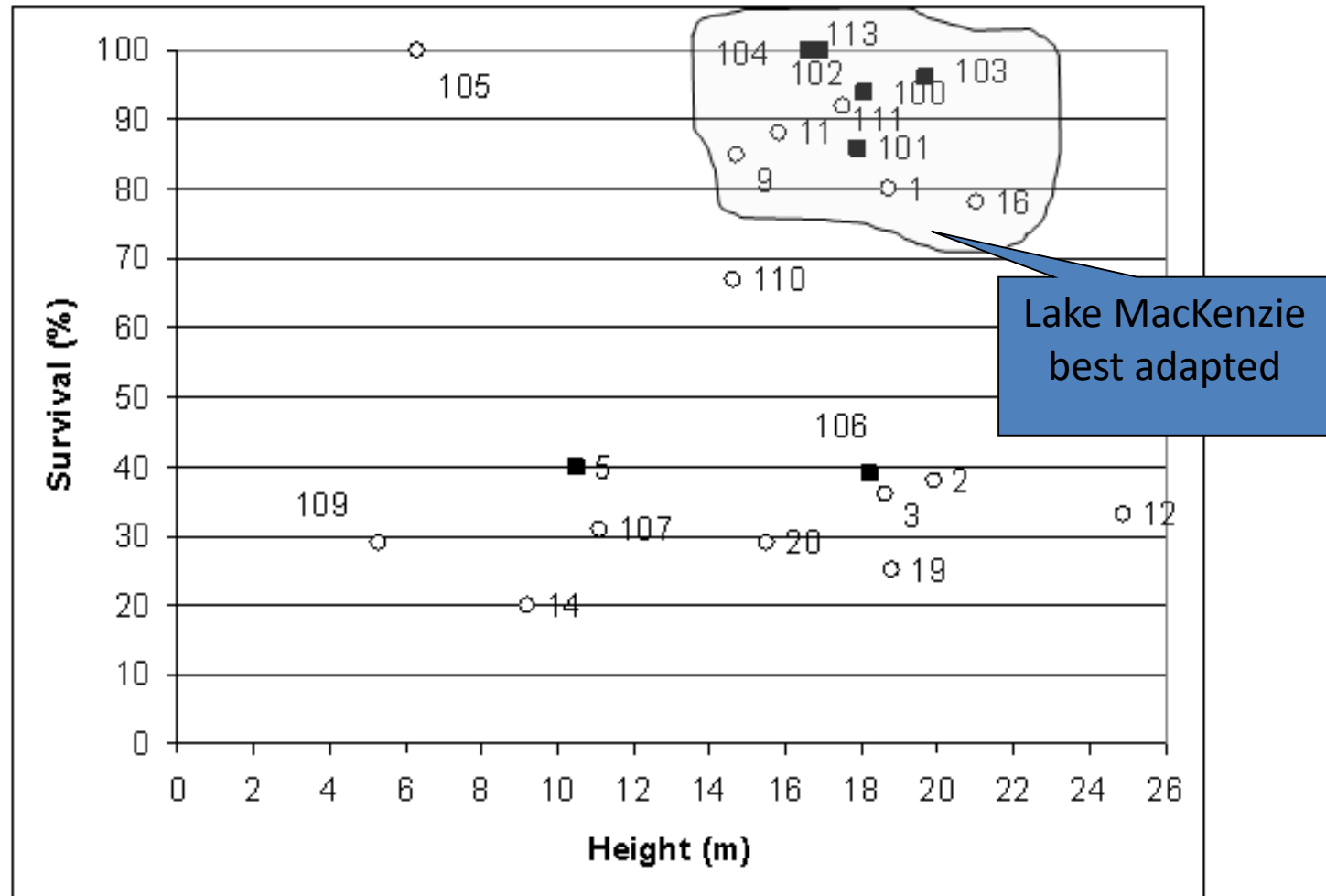




Figure 11 Surviving *E. pauciflora* trees at Wark near Kielder

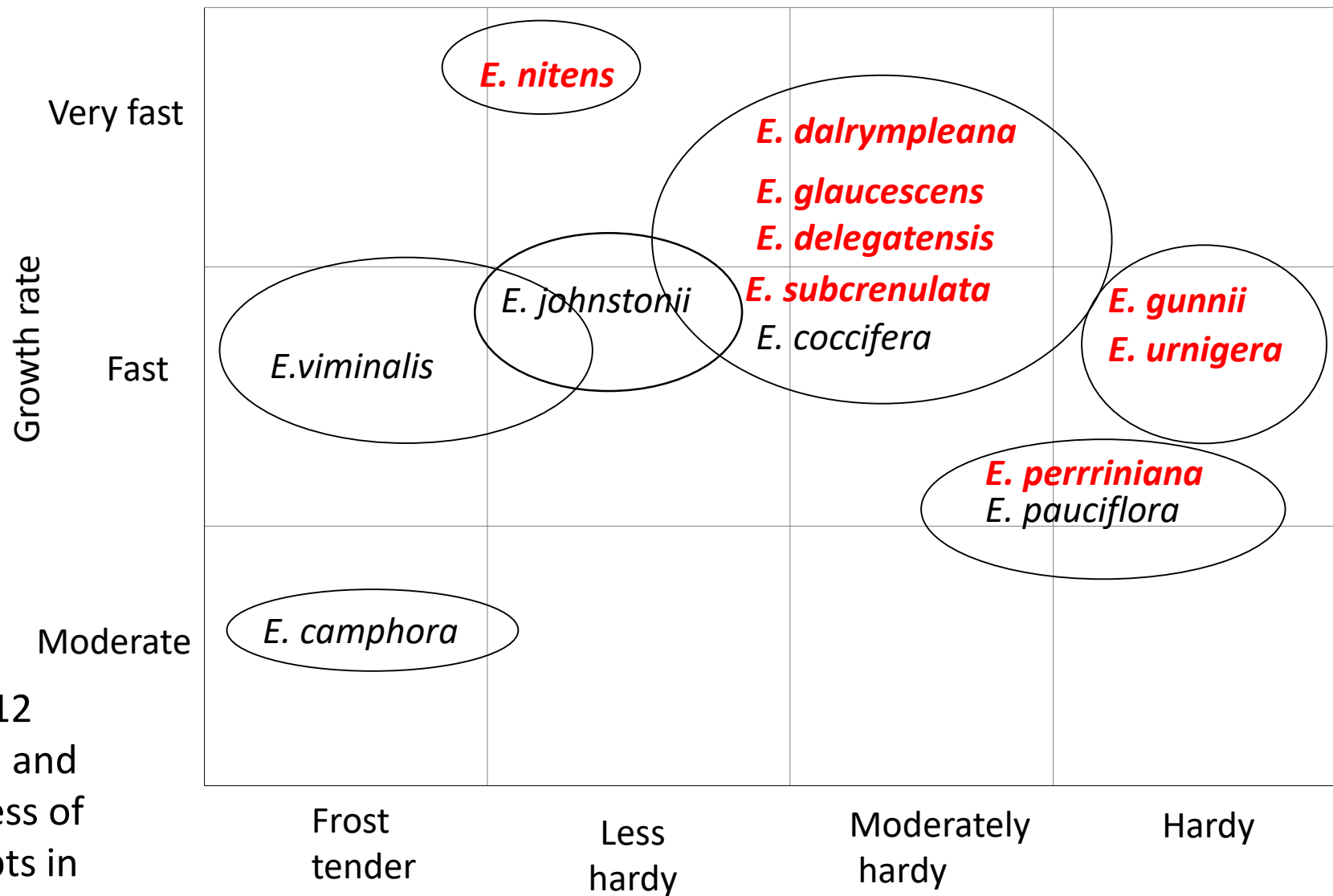


Figure 12
Growth and
hardiness of
eucalypts in
Great Britain

(Leslie, Mencuccini and Perks 2011)

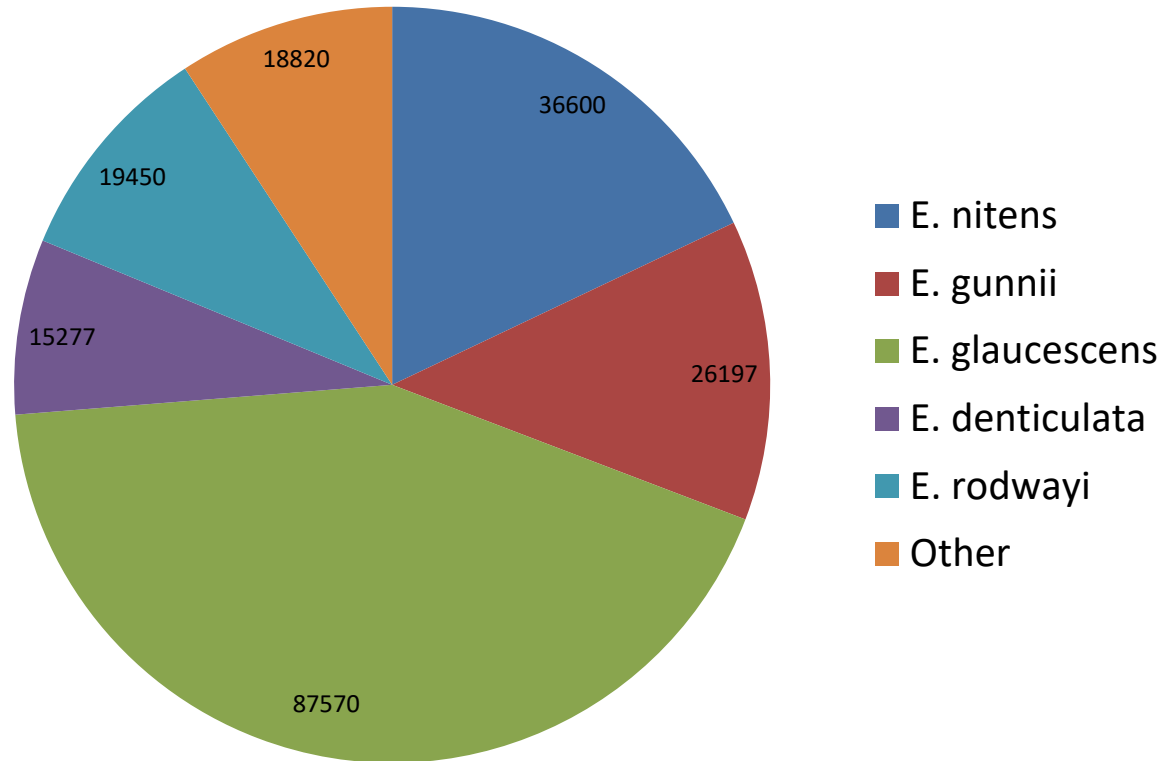
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Table 4 Summary of the best performing origins of species that may have potential in parts of Great Britain, with notes (Purse and Leslie 2016).

Species	Best performing origin	Source	Notes
<i>E. delegatensis</i>	Var <i>tasmaniensis</i> from Ben Lomond, Tasmania	One of the more cold hardy origins in Evans (1986) and confirmed in this study.	Some mainland Australian origins are also hardy (Evans 1986). Recommended for warm areas of south west Britain. A valuable timber tree (FAO 1979).
<i>E. glaucescens</i>	Guthega, New South Wales	The most cold hardy of six origins in Evans (1986)	
<i>E. gunnii</i>	Lake MacKenzie, Tasmania.	One of the most cold hardy origins in Evans (1986) and confirmed Cope, Leslie and Weatherall (2008).	Performs well over a range of locations but variable growth; at 3 years of age trees at Exeter were twice the height of those at Chiddingfold, Thetford, Glenbranter or Wark.
<i>E. nitens</i>	Higher altitude provenances from Victoria.	Evans (1986)	Rapid growth but only to be planted in the least cold and exposed sites.
<i>E. subcrenulata</i>	Mount Cattley, Tasmania	Evans (1986) recommended central or southern Tasmanian origins. Mount Cattley origin recommended in Leslie et al(2014)	To be planted in warm areas of south west Britain

Eucalyptus plantations in GB

Figure 13 Sales of eucalypt plugs by British nurseries 2011 to 2015.
A total of 216,000 eucalyptus plants = 20 ha per year



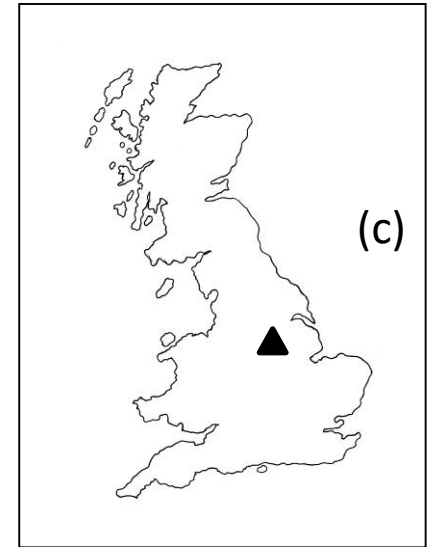
Eucalyptus plantations in GB



(a)



(b)



(c)

Figure 14
Planting at
Daneshill (a)
planting (b) 3
months later (c)
location



Figure 15 *Eucalyptus gunnii* 4.5 years old at Daneshill



Figure 15 *Eucalyptus nitens* 4.5 years old at Daneshill following extreme cold

Records of yields (mass)

Daneshill – Nottinghamshire
24.2ha of Eucalypts planted in
2005. *E gunnii* and *E nitens*.
Stems killed December 2010.



Figure 16 Harvesting (shears)

Woodchip harvested in June 2011
was 2076.4 tonnes or 85.83 tonnes
/ ha or 17.16 tonnes ha⁻¹ year⁻¹
(greenish)



Figure 17 Chipping

(Wooddisse 2011)
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(a)

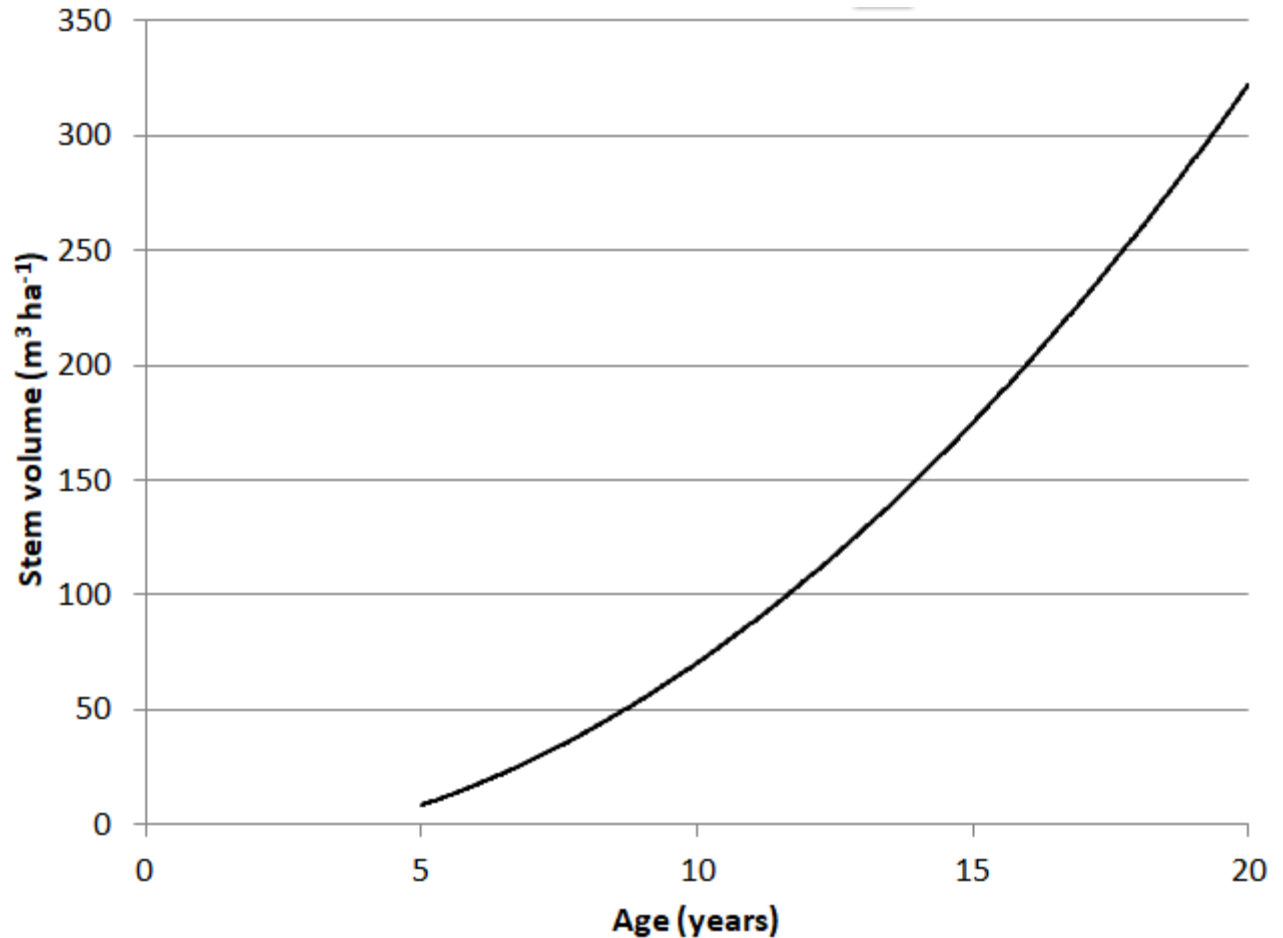


(b)



Figure 18 (a) Coppicing of *E. gunnii* in the Spring of 2011,
(b) Regrowth at 3 years old

Figure 19 Predicted standing overbark stem volume by age. Stocking was assumed to be a constant 1,350 trees ha^{-1} . (Leslie et al 2017)



Conclusion

- Eucalypts have potential as minor production species
- Particularly the case for coastal Ireland
- Rapid producers of biomass
- Relatively free of biotic damaging agents
- Need to refine their site suitability
- Plant species that coppice!

Questions

Further information:

https://www.researchgate.net/profile/Andrew_Leslie